

PATENT ABSTRACTS OF JAPAN

(11)Publication number : **09-082781**
(43)Date of publication of application : **28.03.1997**

(51)Int.Cl. **H01L 21/68**
B01J 19/00
B25J 21/00
H01L 21/02

(21)Application number : **07-263480** (71)Applicant : **KOKUSAI ELECTRIC CO LTD**
(22)Date of filing : **18.09.1995** (72)Inventor : **TERASAKI TADASHI**

(54) SEMICONDUCTOR MANUFACTURING APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce the number of particles on a wafer to be treated by preventing the adhesion of reactive by-product to a partition wall of the inner wall of a transfer chamber and a reaction chamber and facilitating the temperature rise of the reaction chamber.

SOLUTION: A reaction chamber, a cooling chamber and a cassette chamber are disposed at the periphery of a transfer chamber 11. The chambers 12 to 17 can communicate with the chamber 11 via the gate valve of a partition wall. A transfer robot 21 is installed in the chamber 11. The outer surface of the chamber 12 made of a quartz casing is covered with a heater 22. A resistance heating heater is assembled at the ceiling of the chamber 11. The heater is formed of a coiled resistance heater. The temperature of the chamber 11 is regulated based on the room temperature of the chamber 12. When both room temperatures become substantially equal by heating by a heater 24, the valve is opened for communication of the chamber 11 with the chamber 12, and a wafer is moved by the robot 21. The reaction gas component entering the chamber 11 is not sublimated, and not stuck to the inner wall of the chamber 11 as well.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]

[Claim 1] Semiconductor fabrication machines and equipment characterized by having a heating means to heat the above-mentioned conveyance room, in semiconductor fabrication machines and equipment equipped with the reaction chamber equipped with the heating device, and the conveyance room which was opened for free passage and connected to this reaction chamber and held the carrier robot in the interior.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to amelioration of semiconductor fabrication machines and equipment and semiconductor fabrication machines and equipment equipped with the reaction chamber where heat-treatment etc. carries out a semiconductor wafer in detail, and the conveyance room which equipped the carrier robot which takes this semiconductor wafer in and out of this reaction chamber.

[0002]

[Description of the Prior Art] A reaction chamber, a cooling room, a cassette room, etc. are arranged in the perimeter of a conveyance room (robot chamber), and the equipment of a cluster method which opened for free passage and connected each of these ** independently of the conveyance room is known by semiconductor fabrication machines and equipment, such as a CVD system, an oxidation system, and PVD equipment. With the equipment of this cluster method, it makes it possible to do continuously the activity of the diffusion and CVD to the semiconductor wafer which is a processing-object substrate, annealing, etc., without touching atmospheric air.

[0003] And if it was in this type of equipment, it is [that the robot for conveyance is only conventionally held in the conveyance room (buffer room) contiguous to a reaction chamber, and], and the heating device was not equipped. And these reaction chambers and conveyance rooms are configurations opened for free passage and intercepted by closing motion of a gate valve. In order to load with a semiconductor wafer (or substrate) into a reaction chamber, open a gate valve, a conveyance room and a reaction chamber are made to open for free passage, the robot for conveyance of the conveyance interior of a room in this condition is operated, and a semiconductor wafer is inserted in a reaction chamber from a conveyance room. Then, this gate valve is closed and processing of predetermined heating etc. is performed in a reaction chamber. On the contrary, the semiconductor wafer processed in the reaction chamber also opens a gate valve, and is moved from a reaction chamber to a conveyance room by the robot for conveyance. In addition, receipts and payments of the semiconductor wafer to a conveyance room open the gate valve between a cassette room and a conveyance room, and the robot for conveyance is performing them.

[0004]

[Problem(s) to be Solved by the Invention] Thus, in case a semiconductor wafer etc. is transported

between a reaction chamber and a conveyance room, both ** will be in the condition of having been mutually open for free passage. therefore, the conveyance interior of a room -- the ambient atmospheres in a reaction chamber (reactant gas etc.) -- surroundings **** -- it becomes things. However, it of a conveyance room is held at a room temperature thru/or temperature sharply lower than a reaction chamber to the temperature of the reaction chamber at this time being maintained by the high temperature of extent which fell slightly from 600 degrees C. That is, since the ambient temperature changes suddenly at low temperature from an elevated temperature when the gas from a reaction chamber trespasses upon the conveyance interior of a room, a reaction by-product sublimates and adheres at the wall of a conveyance room. And there was fault of being the cause of the particle on the substrate this [whose] is a processing object, for example, a semiconductor wafer.

[0005] Moreover, even if it faces processing in a reaction chamber, heat is taken from the member (septum) which adjoins a conveyance room in a reaction chamber according to the temperature gradient at a conveyance room. For this reason, there was fault that elevated-temperature-izing of the reaction chamber itself was difficult. Moreover, it had the technical problem that a reaction by-product tends to adhere to this septum front face.

[0006] Then, the purpose of this invention is preventing adhesion of a reaction by-product in a conveyance indoor wall. Moreover, other purposes of this invention are to prevent that a reaction by-product adheres to the septum of a reaction chamber. Moreover, this invention sets it as that purpose to make elevated-temperature-ization in a reaction chamber easy. Furthermore, another purpose of this invention is to offer the semiconductor fabrication machines and equipment which can reduce the amount of particle on processing-object substrates (semiconductor wafer etc.).

[0007]

[Means for Solving the Problem] Invention indicated to the claim is equipped with a heating means to heat the above-mentioned conveyance room, in semiconductor fabrication machines and equipment equipped with the reaction chamber equipped with the heating device, and the conveyance room which was opened for free passage and connected to this reaction chamber and held the carrier robot in the interior. As a heating means of this conveyance room, it is possible to build a resistance heating heater into the interior of a conveyance outdoor wall or its wall surface configuration member, for example. Moreover, allotting piping to a conveyance indoor wall and also making this circulate through the liquids (silicone oil etc.) of high temperature as a heating means is considered.

[0008] According to this invention, a conveyance room can be heated and that temperature control becomes easy. Therefore, considering as the approximated value becomes easy identically to it of a reaction chamber about the room temperature of a conveyance room. For example, when a reaction chamber is high temperature, by considering as the temperature approximated to this, the dive of the temperature of the reactant gas at the time of making both ** open for free passage can be prevented, and a conveyance room can also prevent completely adhesion of a by-product in the wall by sublimation of the component in gas. Moreover, adhesion of the by-product to the reaction chamber septum side at the time of intercepting a reaction chamber and a conveyance room can also be prevented. Furthermore, elevated-temperature-ization of a reaction chamber can also be attained promptly.

[0009]

[Embodiment of the Invention] Hereafter, one example of the semiconductor fabrication machines and equipment concerning this invention is explained with reference to a drawing. Drawing 1 - drawing 3 show the semiconductor fabrication machines and equipment concerning one example. If it is in this example, the example which applied this invention is shown in the dispersion equipment (sheet mold) of a cluster type as semiconductor fabrication machines and equipment. In these drawings, 11 shows a conveyance room (it is also called a buffer room or a robot chamber), and reaction chambers 12 and 13, cooling rooms 14 and 15, and the cassette rooms 16 and 17 are arranged in the perimeter of this conveyance room 11. In detail, as shown in drawing 2, in the appearance configuration, head lining and a bottom wall are formed in the shape of [of six square shapes] an rectangular pipe, and, as for the conveyance room 11, these ** 12-17 are formed successively corresponding to six side attachment walls corresponding to one side of the six square shapes. That is, each ** 12-17 is attached to the

conveyance room 11 possible [a free passage] through the gate valve 20 prepared in the septum part with the conveyance room 11.

[0010] The robot 21 for conveyance is held and installed in the conveyance room 11, and this robot 21 for conveyance is performing insertion and fetch of the semiconductor wafer (or processing-object substrate) between each ** 12-17. For example, open a gate valve 20 wide, the cassette room 16 and the conveyance room 11 are made to open for free passage, the robot 21 (TSUIZA) for conveyance is operated, and a semiconductor wafer is once taken out from the cassette room 16 in the conveyance room 11. And this gate valve 20 is closed, opens another gate valve 20 between reaction chambers 12 wide, and inserts and loads with a semiconductor wafer in a reaction chamber 12.

[0011] Each reaction chambers 12 and 13 are the housing structures made from a quartz, and they are attached in the perimeter, respectively so that a heater 22 may cover the external surface. A heater 22 heats efficiently a reaction chamber 12 and the semiconductor wafer with which it was loaded into 13. This heater 22 shall heat reaction chambers 12 and 13 at 600 degrees C or more.

[0012] Here, the above-mentioned conveyance room 11 is equipped with a heating means by which the interior of a room can be heated at 50 degrees C - 100 degrees C. This heating means builds the resistance heating mold heater 24 into the wall surface (head lining) of the conveyance room 11, and is constituted. You may also build this heater 24 into the interior of the outer wall of the conveyance room 11, or a member. The principal part of this heater 24 consists of a coiled form resistance heating element, a thermal break, and a case. Usually, the material of the heating element used is a Fe-Cr-aluminum system alloy with a diameter of 10mm, and what rolled this in the shape of a spiral, supported with the maintenance piece for preventing deformation of a strand, and covered the periphery with the alumina wool yarn heat insulator of a high grade is used. And if it is in this heater 24, in consideration of the flat zone length who is the heater engine performance, a recovery property, a rising-and-falling-temperature property, long duration stability, the radial-temperature-uniformity property, the life, etc., a heater zone size, the diameter of a strand and how to wind, the heat insulation approach, etc. are set up suitably. Moreover, although the heating means is not illustrated, it is equipped with a thermoregulator, and it is setting up temperature of the conveyance room 11 with this thermoregulator.

[0013] If it is in the semiconductor fabrication machines and equipment concerning the above configuration, migration of the semiconductor wafer between each ** 12-17 is performed through the conveyance room 11. When moving a semiconductor wafer to the conveyance room 11 in this case 12, for example, a reaction chamber, it carries out by opening the gate valve 20 prepared in the septum part in the meantime, and making both ** open for free passage. At this time, whenever [room air temperature / of a reaction chamber 12] is detected and measured, and the temperature in the conveyance room 11 is adjusted based on this room temperature. It controls so that the temperature gradient of both [these] ** becomes small. That is, a heater 24 is driven and the conveyance room 11 is heated until it becomes close to reaction chamber 12 temperature. And when both room temperatures become almost equal, open a gate valve 20 and both ** 11 and 12 are made to open for free passage, the robot 21 for conveyance is operated, and a semiconductor wafer is moved. Consequently, it does not adhere to the wall of the conveyance room 11, without also sublimating the component of the reactant gas which invaded in the conveyance room 11. In addition, this gas will be exhausted by the exhaust air means which is not illustrated.

[0014] Moreover, if a semiconductor wafer is taken out from a reaction chamber 12, a gate valve 20 will be closed, for example, the gate valve 20 between cooling rooms 14 will be opened. The robot 21 for conveyance will insert a semiconductor wafer in a cooling room 14. Henceforth, the above-mentioned actuation will be repeated and migration of the semiconductor wafer between each ** will be performed. Moreover, when heat-treating by being loaded with a semiconductor wafer into a reaction chamber 12, it also becomes possible by raising the heating with the room temperature of the conveyance room 11 to heat the reaction chamber 12 quickly.

[0015] Moreover, as a heating means of a conveyance room, various kinds of things other than the above-mentioned example are employable. For example, piping can be laid under the conveyance indoor wall and the liquid controlled by predetermined temperature in this piping can be circulated. In

this case, as a liquid to be used, the high liquid of the boiling points, such as a silicone oil, is suitable on a controllability.

[0016]

[Effect of the Invention] According to this invention, adhesion of a reaction by-product to a conveyance indoor wall and a reaction chamber septum can be reduced sharply. Consequently, the cleaning frequency of a conveyance room and a reaction chamber decreases. Moreover, the number of particle on the semiconductor wafer which is one of the processing-object substrates is also reduced. Moreover, also about the reaction in a reaction chamber, a by-product adheres, the reaction condition of the high-pressure force which was not able to be used also becomes usable, and the width of face of the application of the equipment concerned also spreads.

TECHNICAL FIELD

[Field of the Invention] This invention relates to amelioration of semiconductor fabrication machines and equipment and semiconductor fabrication machines and equipment equipped with the reaction chamber where heat-treatment etc. carries out a semiconductor wafer in detail, and the conveyance room which equipped the carrier robot which takes this semiconductor wafer in and out of this reaction chamber.

PRIOR ART

[Description of the Prior Art] A reaction chamber, a cooling room, a cassette room, etc. are arranged in the perimeter of a conveyance room (robot chamber), and the equipment of a cluster method which opened for free passage and connected each of these ** independently of the conveyance room is known by semiconductor fabrication machines and equipment, such as a CVD system, an oxidation system, and PVD equipment. With the equipment of this cluster method, it makes it possible to do continuously the activity of the diffusion and CVD to the semiconductor wafer which is a processing-object substrate, annealing, etc., without touching atmospheric air.

[0003] And if it was in this type of equipment, it is [that the robot for conveyance is only conventionally held in the conveyance room (buffer room) contiguous to a reaction chamber, and], and the heating device was not equipped. And these reaction chambers and conveyance rooms are configurations opened for free passage and intercepted by closing motion of a gate valve. In order to load with a semiconductor wafer (or substrate) into a reaction chamber, open a gate valve, a conveyance room and a reaction chamber are made to open for free passage, the robot for conveyance of the conveyance interior of a room in this condition is operated, and a semiconductor wafer is inserted in a reaction chamber from a conveyance room. Then, this gate valve is closed and processing of predetermined heating etc. is performed in a reaction chamber. On the contrary, the semiconductor wafer processed in the reaction chamber also opens a gate valve, and is moved from a reaction chamber to a conveyance room by the robot for conveyance. In addition, receipts and payments of the semiconductor wafer to a conveyance room open the gate valve between a cassette room and a conveyance room, and the robot for conveyance is performing them.

EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, adhesion of a reaction by-product to a conveyance indoor wall and a reaction chamber septum can be reduced sharply. Consequently, the cleaning frequency of a conveyance room and a reaction chamber decreases. Moreover, the number of particle on the semiconductor wafer which is one of the processing-object substrates is also reduced. Moreover, also about the reaction in a reaction chamber, a by-product adheres, the reaction condition

of the high-pressure force which was not able to be used also becomes usable, and the width of face of the application of the equipment concerned also spreads.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Thus, in case a semiconductor wafer etc. is transported between a reaction chamber and a conveyance room, both ** will be in the condition of having been mutually open for free passage. therefore, the conveyance interior of a room -- the ambient atmospheres in a reaction chamber (reactant gas etc.) -- surroundings **** -- it becomes things. However, it of a conveyance room is held at a room temperature thru/or temperature sharply lower than a reaction chamber to the temperature of the reaction chamber at this time being maintained by the high temperature of extent which fell slightly from 600 degrees C. That is, since the ambient temperature changes suddenly at low temperature from an elevated temperature when the gas from a reaction chamber trespasses upon the conveyance interior of a room, a reaction by-product sublimates and adheres at the wall of a conveyance room. And there was fault of being the cause of the particle on the substrate this [whose] is a processing object, for example, a semiconductor wafer.

[0005] Moreover, even if it faces processing in a reaction chamber, heat is taken from the member (septum) which adjoins a conveyance room in a reaction chamber according to the temperature gradient at a conveyance room. For this reason, there was fault that elevated-temperature-izing of the reaction chamber itself was difficult. Moreover, it had the technical problem that a reaction by-product tends to adhere to this septum front face.

[0006] Then, the purpose of this invention is preventing adhesion of a reaction by-product in a conveyance indoor wall. Moreover, other purposes of this invention are to prevent that a reaction by-product adheres to the septum of a reaction chamber. Moreover, this invention sets it as that purpose to make elevated-temperature-ization in a reaction chamber easy. Furthermore, another purpose of this invention is to offer the semiconductor fabrication machines and equipment which can reduce the amount of particle on processing-object substrates (semiconductor wafer etc.).

MEANS

[Means for Solving the Problem] Invention indicated to the claim is equipped with a heating means to heat the above-mentioned conveyance room, in semiconductor fabrication machines and equipment equipped with the reaction chamber equipped with the heating device, and the conveyance room which was opened for free passage and connected to this reaction chamber and held the carrier robot in the interior. As a heating means of this conveyance room, it is possible to build a resistance heating heater into the interior of a conveyance outdoor wall or its wall surface configuration member, for example. Moreover, allotting piping to a conveyance indoor wall and also making this circulate through the liquids (silicone oil etc.) of high temperature as a heating means is considered.

[0008] According to this invention, a conveyance room can be heated and that temperature control becomes easy. Therefore, considering as the approximated value becomes easy identically to it of a reaction chamber about the room temperature of a conveyance room. For example, when a reaction chamber is high temperature, by considering as the temperature approximated to this, the dive of the temperature of the reactant gas at the time of making both ** open for free passage can be prevented, and a conveyance room can also prevent completely adhesion of a by-product in the wall by sublimation of the component in gas. Moreover, adhesion of the by-product to the reaction chamber septum side at the time of intercepting a reaction chamber and a conveyance room can also be prevented. Furthermore, elevated-temperature-ization of a reaction chamber can also be attained promptly.

[0009]

[Embodiment of the Invention] Hereafter, one example of the semiconductor fabrication machines and

equipment concerning this invention is explained with reference to a drawing. Drawing 1 - drawing 3 show the semiconductor fabrication machines and equipment concerning one example. If it is in this example, the example which applied this invention is shown in the dispersion equipment (sheet mold) of a cluster type as semiconductor fabrication machines and equipment. In these drawings, 11 shows a conveyance room (it is also called a buffer room or a robot chamber), and reaction chambers 12 and 13, cooling rooms 14 and 15, and the cassette rooms 16 and 17 are arranged in the perimeter of this conveyance room 11. In detail, as shown in drawing 2, in the appearance configuration, head lining and a bottom wall are formed in the shape of [of six square shapes] an rectangular pipe, and, as for the conveyance room 11, these ** 12-17 are formed successively corresponding to six side attachment walls corresponding to one side of the six square shapes. That is, each ** 12-17 is attached to the conveyance room 11 possible [a free passage] through the gate valve 20 prepared in the septum part with the conveyance room 11.

[0010] The robot 21 for conveyance is held and installed in the conveyance room 11, and this robot 21 for conveyance is performing insertion and fetch of the semiconductor wafer (or processing-object substrate) between each ** 12-17. For example, open a gate valve 20 wide, the cassette room 16 and the conveyance room 11 are made to open for free passage, the robot 21 (TSUIZA) for conveyance is operated, and a semiconductor wafer is once taken out from the cassette room 16 in the conveyance room 11. And this gate valve 20 is closed, opens another gate valve 20 between reaction chambers 12 wide, and inserts and loads with a semiconductor wafer in a reaction chamber 12.

[0011] Each reaction chambers 12 and 13 are the housing structures made from a quartz, and they are attached in the perimeter, respectively so that a heater 22 may cover the external surface. A heater 22 heats efficiently a reaction chamber 12 and the semiconductor wafer with which it was loaded into 13. This heater 22 shall heat reaction chambers 12 and 13 at 600 degrees C or more.

[0012] Here, the above-mentioned conveyance room 11 is equipped with a heating means by which the interior of a room can be heated at 50 degrees C - 100 degrees C. This heating means builds the resistance heating mold heater 24 into the wall surface (head lining) of the conveyance room 11, and is constituted. You may also build this heater 24 into the interior of the outer wall of the conveyance room 11, or a member. The principal part of this heater 24 consists of a coiled form resistance heating element, a thermal break, and a case. Usually, the material of the heating element used is a Fe-Cr-aluminum system alloy with a diameter of 10mm, and what rolled this in the shape of a spiral, supported with the maintenance piece for preventing deformation of a strand, and covered the periphery with the alumina wool yarn heat insulator of a high grade is used. And if it is in this heater 24, in consideration of the flat zone length who is the heater engine performance, a recovery property, a rising-and-falling-temperature property, long duration stability, the radial-temperature-uniformity property, the life, etc., a heater zone size, the diameter of a strand and how to wind, the heat insulation approach, etc. are set up suitably. Moreover, although the heating means is not illustrated, it is equipped with a thermoregulator, and it is setting up temperature of the conveyance room 11 with this thermoregulator.

[0013] If it is in the semiconductor fabrication machines and equipment concerning the above configuration, migration of the semiconductor wafer between each ** 12-17 is performed through the conveyance room 11. When moving a semiconductor wafer to the conveyance room 11 in this case 12, for example, a reaction chamber, it carries out by opening the gate valve 20 prepared in the septum part in the meantime, and making both ** open for free passage. At this time, whenever [room air temperature / of a reaction chamber 12] is detected and measured, and the temperature in the conveyance room 11 is adjusted based on this room temperature. It controls so that the temperature gradient of both [these] ** becomes small. That is, a heater 24 is driven and the conveyance room 11 is heated until it becomes close to reaction chamber 12 temperature. And when both room temperatures become almost equal, open a gate valve 20 and both ** 11 and 12 are made to open for free passage, the robot 21 for conveyance is operated, and a semiconductor wafer is moved. Consequently, it does not adhere to the wall of the conveyance room 11, without also sublimating the component of the reactant gas which invaded in the conveyance room 11. In addition, this gas will be exhausted by the exhaust air means which is not illustrated.

[0014] Moreover, if a semiconductor wafer is taken out from a reaction chamber 12, a gate valve 20 will be closed, for example, the gate valve 20 between cooling rooms 14 will be opened. The robot 21 for conveyance will insert a semiconductor wafer in a cooling room 14. Henceforth, the above-mentioned actuation will be repeated and migration of the semiconductor wafer between each ** will be performed. Moreover, when heat-treating by being loaded with a semiconductor wafer into a reaction chamber 12, it also becomes possible by raising the heating with the room temperature of the conveyance room 11 to heat the reaction chamber 12 quickly.

[0015] Moreover, as a heating means of a conveyance room, various kinds of things other than the above-mentioned example are employable. For example, piping can be laid under the conveyance indoor wall and the liquid controlled by predetermined temperature in this piping can be circulated. In this case, as a liquid to be used, the high liquid of the boiling points, such as a silicone oil, is suitable on a controllability.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing a part for the principal part of the semiconductor fabrication machines and equipment concerning one example of this invention.

[Drawing 2] It is the top view showing the semiconductor fabrication machines and equipment concerning one example of this invention.

[Drawing 3] The semiconductor fabrication machines and equipment concerning one example of this invention are shown, and it is the III-III line arrowed cross-section Fig. of drawing 2 .

[Description of Notations]

11 Conveyance Room

12 13 Reaction chamber

20 Gate Valve

21 Robot for Conveyance

22 Heater for Reaction Chamber Heating

24 Heater for Conveyance Room Heating

(19)日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11)特許出願公開番号

特開平9-82781

(43)公開日 平成9年(1997)3月28日

(51)Int.Cl. ⁸	識別記号	序内整理番号	F I	技術表示箇所
H 01 L 21/68			H 01 L 21/68	A
B 01 J 19/00	3 0 1		B 01 J 19/00	3 0 1 Z
B 25 J 21/00			B 25 J 21/00	
H 01 L 21/02			H 01 L 21/02	Z

審査請求 未請求 請求項の数1 FD (全4頁)

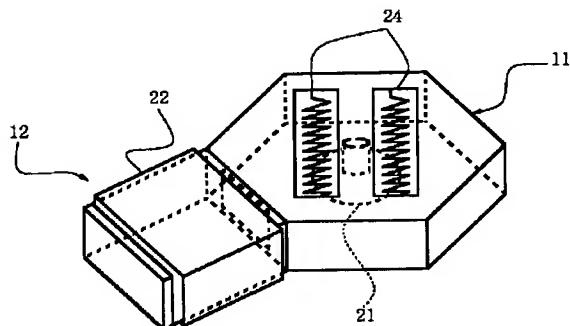
(21)出願番号	特願平7-263480	(71)出願人	000001122 国際電気株式会社 東京都中野区東中野三丁目14番20号
(22)出願日	平成7年(1995)9月18日	(72)発明者	寺崎 正 東京都中野区東中野三丁目14番20号 国際 電気株式会社内
		(74)代理人	弁理士 守山 辰雄

(54)【発明の名称】 半導体製造装置

(57)【要約】

【課題】 搬送室内壁・反応室との隔壁への反応副生成物の付着を防止する。反応室の高温化を容易にする。処理対象基板上のパーティクル数を低減する。

【解決手段】 搬送室11の周囲に反応室、冷却室、カセット室を配設する。各室12～17を隔壁のゲートバルブ20で搬送室11に連通可能とする。搬送室11内には搬送用ロボット21を設置する。石英製筐体からなる反応室12の外面はヒータ22で被覆する。また、搬送室11の天井に抵抗加熱型ヒータ24を組み込む。ヒータ24はコイル状抵抗発熱体等で構成する。反応室12の室温に基づき搬送室11内の温度を調節する。ヒータ24で加熱し、両室温が略等しくなるとゲートバルブ20を開けて両室11, 12を連通させ、ロボット21でウェーハを移す。搬送室11内に侵入した反応ガス成分も昇華せず、搬送室11内壁に付着することもない。



【特許請求の範囲】

【請求項1】 加熱機構を備えた反応室と、この反応室に連通して接続され、内部に搬送ロボットを収容した搬送室と、を備えた半導体製造装置において、上記搬送室を加熱する加熱手段を備えたことを特徴とする半導体製造装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は半導体製造装置、詳しくは半導体ウェーハを加熱処理等する反応室とこの反応室に該半導体ウェーハを出し入れする搬送ロボットを装備した搬送室とを備えた半導体製造装置の改良に関する。

【0002】

【従来の技術】CVD装置・酸化装置・PVD装置等の半導体製造装置には、搬送室（ロボットチャンバ）の周囲に反応室・冷却室・カセット室等を配設し、これらの室のそれぞれを搬送室に独立に連通・接続したクラスタ方式の装置が知られている。このクラスタ方式の装置では、大気に触れることなく、処理対象基板である半導体ウェーハに対する拡散、CVD、アニール等の作業を連続して行うことを可能とするものである。

【0003】そして、このタイプの装置にあっては、従来、反応室に隣接する搬送室（バッファ室）には、搬送用ロボットが収容されているのみであり、加熱機構は装備されてはいなかった。そして、これらの反応室と搬送室とはゲートバルブの開閉で連通・遮断される構成である。半導体ウェーハ（または基板）を反応室内に装填するには、ゲートバルブを開け、搬送室と反応室とを連通させ、この状態で搬送室の搬送用ロボットを作動させ、搬送室から半導体ウェーハを反応室に挿入する。その後、このゲートバルブは閉じられて反応室で所定の加熱などの処理が施される。逆に、反応室で処理された半導体ウェーハも、ゲートバルブを開けて、搬送用ロボットにより反応室から搬送室に移される。なお、搬送室への半導体ウェーハの出し入れは、カセット室と搬送室との間のゲートバルブを開けて搬送用ロボットにより行っている。

【0004】

【発明が解決しようとする課題】このように半導体ウェーハ等を反応室と搬送室との間で移送する際、両室は互いに連通した状態となる。したがって、搬送室内に反応室内の雰囲気（反応ガス等）が入り込むこととなる。ところが、このときの反応室の温度は、例えば600℃からわずかに低下した程度の高温度に維持されているのに対し、搬送室のそれは室温乃至反応室よりは大幅に低い温度に保持されている。すなわち、反応室からの気体が搬送室内に侵入した際、その雰囲気温度が高温から低温に急変するため、搬送室の内壁に反応副生成物が昇華・付着する。そして、これが処理対象である基板、例え

ば半導体ウェーハ上のパーティクルの原因となっているという不具合があった。

【0005】また、反応室での処理に際しても、その温度差により、反応室内で搬送室と隣接する部材（隔壁）から搬送室に熱が奪われる。このため、反応室自体の高温化が困難であるという不具合があった。また、反応副生成物がこの隔壁表面に付着し易いという課題を有していた。

【0006】そこで、この発明の目的は、搬送室内壁への反応副生成物の付着を防止することである。また、この発明の他の目的は、反応室の隔壁に反応副生成物が付着することを防止することにある。また、この発明は、反応室での高温化を容易にすることを、その目的としている。さらに、この発明の別の目的は、処理対象基板（半導体ウェーハ等）上のパーティクル量を低減することができる半導体製造装置を提供することにある。

【0007】

【課題を解決するための手段】請求項に記載した発明は、加熱機構を備えた反応室と、この反応室に連通して接続され、内部に搬送ロボットを収容した搬送室と、を備えた半導体製造装置において、上記搬送室を加熱する加熱手段としては、例えば搬送室外壁またはその壁面構成部材の内部に抵抗加熱ヒータを組み込むことが考えられる。また、加熱手段として、搬送室内壁に配管を配して、これに高温度の液体（シリコンオイル等）を循環させることも考えられる。

【0008】この発明によれば、搬送室を加熱することができ、その温度コントロールが容易となる。よって、搬送室の室温を反応室のそれと同一または近似した値とすることが容易となる。例えば反応室が高温度の場合は搬送室もこれに近似した温度とすることで、両室を連通させたときの反応ガスの温度の急降下を防ぎ、ガス中成分の昇華による内壁への副生成物の付着を完全に阻止することができる。また、反応室と搬送室とを遮断した場合の反応室隔壁への副生成物の付着をも防止することができる。さらに、反応室の高温化も速やかに達成することができる。

【0009】

【発明の実施の形態】以下、この発明に係る半導体製造装置の一実施例を図面を参照して説明する。図1～図3は一実施例に係る半導体製造装置を示している。この実施例にあっては、半導体製造装置としてクラスタ型の拡散装置（枚葉型）にこの発明を適用した例を示している。これらの図において、11は搬送室（バッファ室またはロボットチャンバともいう）を示し、この搬送室11の周囲に反応室12、13、冷却室14、15、カセット室16、17が配設されている。詳しくは、図2に示すように、搬送室11は、その外観形状において天井および底壁が6角形の角筒状に形成され、その6角形の

一辺に対応した6つの側壁に対応してこれらの室12～17が連設されている。すなわち、各室12～17は、搬送室11との隔壁部分に設けたゲートバルブ20を介して搬送室11に連通可能に付設されている。

【0010】搬送室11内には搬送用ロボット21が収容・設置されており、この搬送用ロボット21は各室12～17の間での半導体ウェーハ（または処理対象基板）の挿入・取出を行っている。例えばゲートバルブ20を開放してカセット室16と搬送室11とを連通させ、搬送用ロボット21（ツイーザ）を作動させてカセット室16から搬送室11に半導体ウェーハをいったん取り出す。そして、このゲートバルブ20は閉じて反応室12との間の別のゲートバルブ20を開放して反応室12に半導体ウェーハを挿入・装填するものである。

【0011】各反応室12、13は石英製の筐体構造であって、その周囲には、それぞれ、ヒータ22がその外面を被覆するように取り付けられている。ヒータ22は反応室12、13内に装填された半導体ウェーハを効率的に加熱するものである。このヒータ22は反応室12、13を例えれば600°C以上に加熱することができるものとする。

【0012】ここで、上記搬送室11には例えれば50°C～100°Cにその室内を加熱可能な加熱手段が装備されている。この加熱手段は、搬送室11の壁面（天井）に抵抗加熱型ヒータ24を組み込んで構成されている。このヒータ24は搬送室11の外壁または部材内部に組み込んでもよい。このヒータ24の主要部は、例えばコイル状の抵抗発熱体、断熱層、ケースで構成されている。通常使用される発熱体の素材は、直径10mmのFe-Cr-A1系合金であり、これをスパイラル状に巻き、素線の変形を防止するための保持ピースで支え、その外周を高純度のアルミナウール断熱材で覆ったものが用いられている。そして、このヒータ24にあっては、ヒータ性能である均熱長、リカバリー特性、昇降温特性、長時間安定性、断面均熱特性、寿命などを考慮してヒータゾーン広さ、素線径および巻き方、断熱方法などが適宜設定されている。また、加熱手段は、図示していないが温度調節器を備え、この温度調節器により搬送室11の温度の設定を行っている。

【0013】以上の構成に係る半導体製造装置にあっては、各室12～17間での半導体ウェーハの移送は搬送室11を介して行われる。この際、例えば反応室12から搬送室11に半導体ウェーハを移す場合は、その間の隔壁部分に設けたゲートバルブ20を開けて両室を連通させて行う。このとき、反応室12の室内温度を検出・測定し、この室温に基づいて搬送室11内の温度を調節する。これら両室の温度差が小さくなるようにコントロールする。すなわち、反応室12温度に近くなるまでヒ

ータ24を駆動して搬送室11を加熱するものである。そして、両室温がほぼ等しくなったときゲートバルブ20を開けて両室11、12を連通させ、搬送用ロボット21を作動させて半導体ウェーハを移す。この結果、搬送室11内に侵入した反応ガスの成分も昇華することなく、搬送室11の内壁に付着することもない。なお、このガスは、図示していない排気手段により排気されることとなる。

【0014】また、半導体ウェーハが反応室12から取り出されるとゲートバルブ20は閉じられ、例えば冷却室14との間のゲートバルブ20が開かれる。搬送用ロボット21は半導体ウェーハを例えれば冷却室14に挿入することとなる。以後、上記操作が繰り返されて各室間での半導体ウェーハの移送が行われることとなる。また、反応室12内に半導体ウェーハが装填されて加熱処理を行う場合、搬送室11の室温をその加熱に伴い上昇させることで、その反応室12の加熱を迅速に行うことも可能となる。

【0015】また、上記実施例の他にも、搬送室の加熱手段としては各種のものが採用することができる。例えば搬送室内壁に配管を埋設し、この配管中に所定温度に制御された液体を循環させることができる。この場合、使用する液体としてはシリコンオイル等の沸点の高い液体が制御性上好適である。

【0016】

【発明の効果】この発明によれば、搬送室内壁および反応室隔壁への反応副生成物の付着を大幅に低減することができる。その結果、搬送室、反応室のクリーニング頻度が低減する。また、処理対象基板の一つである半導体ウェーハ上のパーティクル数も低減する。また、反応室での反応に関しても、副生成物が付着して実用不可能だった高圧力の反応条件も実用可能となり、当該装置の用途の幅も広がる。

【図面の簡単な説明】

【図1】この発明の一実施例に係る半導体製造装置の主要部分を示す斜視図である。

【図2】この発明の一実施例に係る半導体製造装置を示す平面図である。

【図3】この発明の一実施例に係る半導体製造装置を示すもので図2のIII-III線矢視断面図である。

【符号の説明】

11 搬送室

12, 13 反応室

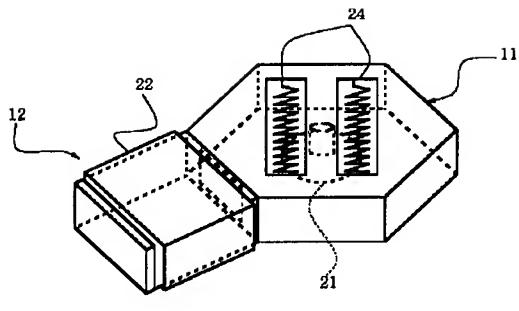
20 ゲートバルブ

21 搬送用ロボット

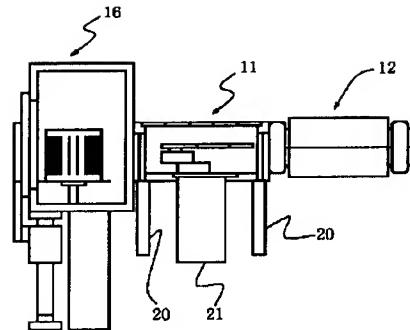
22 反応室加熱用ヒータ

24 搬送室加熱用ヒータ

【図1】



【図3】



【図2】

